PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

System For Salmon Migrating Through Dams

BPA project number: 20099
Contract renewal date (mm/yyyy): ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Krick Salmon Survival Systems

Business acronym (if appropriate)

Proposal contact person or principal investigator:

Name	Edward Krick, CPA
Mailing Address	38720 Proctor Blvd, Ste 102
City, ST Zip	Sandy, Oregon 97055
Phone	503-668-5615
Fax	503-668-3592
Email address	krick@novaport.com

NPPC Program Measure Number(s) which this project addresses
Innovative Project

FWS/NMFS Biological Opinion Number(s) which this project addresses
N/A

Other planning document references
None

Short description
System to reduce losses of Salmon Migrating Through Dams.

Target species
All Anadromous Smolts Migrating Past Dams

Section 2. Sorting and evaluation

Subbasin
Columbia River Drainage/All Rivers With Hatcheries

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories
☒ Anadromous fish ☐ Resident fish ☐ Wildlife	Multi-year (milestone-based evaluation) ☐ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☐ Operation & maintenance ☐ New construction ☐ Research & monitoring ☐ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
0	None	

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
	None Related To Wildlife	

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Train Hatchery Smolts	a	Modify 3 Hatchery Pens
1		b	Test Train Smolts
2	Capture Smolts at Dam	a	Design and Build Equipment
2		b	Capture Trained Smolts

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	3/2000	4/2000	% Trained Successfully	95 % Find Feed	42.00%
2	4/2000	5/2000	% Collected At Dams	30% Of	58.00%
				Trainees *	
				Only 1 Collector*	
				Total	100%

Schedule constraints

Completion date

Section 5. Budget

FY99 project budget (BPA obligated):

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel	Project Management		15,000
Fringe benefits	Payroll Taxes		1,500
Supplies, materials, non-expendable property	Feed and Miscellaenous		8,000
Operations & maintenance	Volunteer		0
Capital acquisitions or improvements (e.g. land, buildings, major equip.)	Equipment		$65,000
NEPA costs	Compliance		1,500
Construction-related			

support			
PIT tags	# of tags: Unknown -		1,000
Travel	Meetings and Work Sites		4,000
Indirect costs	Office, Telephone, Supplies		6,000
Subcontractor	Grad. Students/ Skilled Retirees		35,000
Other	Reserve		$8,000
TOTAL BPA FY2000 BUDGET REQUEST			$145,000

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
Total project cost (including BPA portion)			$145,000

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget				

Section 6. References

Watershed?	Reference
☐	
☐	
☐	
☐	

PART II - NARRATIVE

Section 7. Abstract

This proposal addresses a method for moving salmon safely through dams reducing mortality significantly. It is low cost and requires no modification to hydrostructures.

1. Smolts are trainable. Use the feeding process at the hatchery to train smolts to search for feed using water current and light stimulus to locate food. Light

alone is insufficient because turbidity limits vision. Following current is a natural instinct that will be useful to collecting smolts at the dam.

2. Above the dams, position floating collectors in the current paths created by the turbines to intercept and capture smolts.

3. In support of the collector system, use sensor equipment and a computer program to map and predict paths of smolts as they approach the dam. Data will improve positioning of collectors.

4. Collectors are small barge like boats with a pump, a holding tank,and large underwater opening at the bow. The collectors will pump water into the holding tank, creating faster current to help lead smolts in closer.

5. Collectors will mimic the feeding process at the hatcheries. As the smolts follow the current they will encounter the collectors. The light and feed will agitate them into swarming forward, where they will be sucked into the holding tank.

6. Water will be pumped from the holding tank through tubing to the head of the fish ladder. The ladder will have a partition to shunt juveniles down inside the dam and out the opening nearest the shoreline. This helps returning adults identify the path.

7. Wild smolts may be drawn into the same process by following current flows and be led by swarming hatchery pathfinders into the collectors.

8. This is a low cost concept. It is easy to test and verify.

Section 8. Project description

a. Technical and/or scientific background

Business planner and business systems designer

b. Rational and significance to Regional Programs

1) Benefits to upstream projects by providing reliable method for getting juveniles through dams.
2) Temporarily provides more hatchery fish for commercial and sport fisheries until wild recovery programs take hold.
3) Method is very low cost. Frees up funds for many other programs.
4) Conserves water for power generation.
5) Does not require modification or breaching of dams.
6) Protects eastern Oregon, Idaho and Washington economic interests.
7) Creates rational for agriculture, timber , cattle, and other industry to participate in habitat restoration projects. Until the problem of passage through the dams

is solved, it can always be said, “ Why spend any money when salmon can’t survive the dams?”

8) Method promises to aid wild salmon. Even if the collection system is bypassed by wild juveniles, reduction in predation rates at the dams will benefit them significantly

c. Relationships to other projects

Unknown, except as listed above (b)

d. Project history (for ongoing projects)

New

e. Proposal objectives

1 Provide a reliable method for hatchery smolts to negotiate passage through any dam. Reduce losses at each dam by 50%.

2) Reduce predation losses by 50%

3) Increase percentage of Snake River smolts reaching the ocean to 60%. Current estimate by Fish and Wildlife estimates only 20%. If 50% of hatchery juveniles use the collector bypass system and predation can be reduced by 50%, than the number of smolts reaching the ocean can be tripled from 20% to 60%.

4) Replace costly and failed methods of spillage and turbine passage. Eliminate barge transportation which has proven unsuccessful.

5) Reduce adult migration losses of 16% per dam by 50%.

6) Research the concept of using hatchery pathfinders to lead wild juveniles to the collectors and through the dams.

7) Provide a unified systems approach to controlling losses at each dam. By controlling all losses at each dam with a systematic quality control program, adults returning passed eight dams to the upper Snake River, could be multiplied If the overall system was only 1/3 effective, returning adults would double. If the system achieved a 50% reduction in loss rates, returns would increase sixfold. If 75% efficiency is attained, more than ten times as many adults would be available for spawning and harvest. A unified systematic approach to all problems associated with passage through the dams is the only productive approach. Each dam should have its own plan, with a statistical profile of all loss rates, and quality control objectives for improvement. Until this approach is taken, improvements will be elusive.

f. Methods

Here is the summary of the method used by this system:

1) Train hatchery smolts to use water current and light stimulus to locate food. Feeding methods used now by hatcheries “train” juveniles. Smolts swarming towards attendants at feeding time is an exhibition of learned behavior. This proposal merely upgrades this learned behavior to make it productive to their survival. Salmon

are the forgotten agents of their own survival. Nature has programmed them with instincts primed for turbulent and wild rivers, not the controlled environment they encounter today. It is reasonable to provide them with tools needed to pass through the dams that constitute todays reality. It is destructive to their survival to dull their wild instincts with feeding methods that are not demanding and intensive. This training program would occur in the last one or two months before release and would last only two or three weeks. This lets the program fit in with other procedural changes at the hatcheries that are being made to improve survival rates.

2) Water flow (current) is used as a natural factor for inducing smolts to follow a desired path. Current will be introduced to the feeding process at the hatchery by connecting two pens with two tubes for passage. A pump will raise water level in the exit pen and lower water in the target pen. When the gate is opened water will flow to the target pen. A blinking light near the feeder in the target pen will also be used as an attractor. This system will train the smolts to follow current and use light to find feed. The collectors at the dams will use the same methods to attract smolts.

3) Four to eight collectors will be placed in the migratory paths of the juveniles as they approach the dam. Placing multiple systems out in the river increases the chances of the method working. Simply put, you have to go where the fish are. Shore based systems are too remote and inflexible to succeed.

4) A system will be developed for each dam to track and map the paths of juveniles as they approach the dam. Collection efficiency will multiple as these paths become known. Sensor equipment will track tagged smolts and transmit data to a computer system to create a data base for each dam. The data will be used to position the collectors.

5) Collectors will accelerate the existing current, drawing smolts in closer. The swifter current may also attract the wild juveniles.

6) Lights and feed, identical to the hatchery system, will cause hatchery juveniles to school and surge forward to the collector where they will be sucked into a holding tank. The blinking light will be hooded by the underside of the collector to increase effectiveness in daylight hours.

7) Wild salmon juveniles may follow the same general routes as they approach the dam. If this is true, they will encounter the collectors. As they approach the collector, the stronger current may induce them to follow the faster water into the collector on their own. They may also be influenced by the behavior of the hatchery smolts swarming after feed, and instinctively join in the pursuit of food.

8) Captured smolts will swim through a tube from the holding tank to the top of the fish ladder. The tube, like the ones at the hatchery, will have positive current flow and offer the only path for advancing. They will go down a partition of the ladder to inside the dam (or down a shore based ladder for some dams). The juveniles will exit the dam at the opening nearest the shore. It will be necessary for provide a conduit tube for swimming down stream and away from the base of the dam. Such a tube will benefit returning adults by leading them along a previously experienced path to the interior of the dam. The tube also serves the very useful purpose of attracting squawfish. Why this is useful will be covered later. If just 50% of the juveniles are enticed down this path, a significant increase occurs in returning adults.

9) Adults will return along the path experienced as juveniles. This system gives them the experience of passing through the interior of the dams. That experience should help reduce upstream losses of 16% per dam, apparently caused by confusion and the reluctance to enter a foreign structure. Essentially what we are doing in

this entire process, is to reprogram the salmon to cope with the environment as they now find it, with dams lying along their migratory path, not the turbulent rivers of their ancestry.

10) Squawfish predators are attracted to their prey. Large concentrations of salmon juveniles will occur, above the dams at the collectors, and below the dams at the exit from the tubes. This will set up conditions ideal for the eradication of the squawfish. Traps will harvest mature squawfish as they are inevitably drawn into the prime feeding waters near these points. Assume the following profile: 10,000 squawfish per square mile, 20% of which are predacious adults, and 120 square miles between dams. This amounts to 1.2 million squawfish, of which 240,000 are mature. Mathematically, 240,000 adults could be harvested using four traps, catching 10 adults an hour each, in just 250 days. With fewer adults available for reproduction, replacement rates would plunge. As more smolts are induced to use the ladder, and less stunned and wounded juveniles exit the turbines or spillways, predators will be drawn as if on a string to the most productive feeding grounds. Using smolts as baitfish to attract squawfish is a natural method that takes advantage of the predators instinct to move to the food supply. The goal of this subsystem is to cut overall predation rates at the dam by 90%. The writer assumes that this translates into reducing total predation losses in the entire ecosystem by 50%. In other words, losses to terns, walleye pike, and squawfish farther away from the dam, continue unabatedl

11) The systems method has been used in studying the problem of passage through the dams. It has led me to the conclusion that stand alone solutions will fall short of producing significant increases in spawning adults. The mathematics of multiple attrition rates are too devastating for piecemeal solutions. Of 1.0 million smolts from the upper Snake River, only 1,190 make it back through 8 dams for reproduction. See Table A. This is the absoulte minimum needed for replacement spawning of the 1.0 million smolts.

On the other hand, by reducing each loss factor encountered at each dam by 50%, adults returning to the upper Snake River would increase sixfold to 7,390. If 75% system efficiency is attained, the number reaches 13,843 while also providing many more fish for harvest.

CONCLUSION

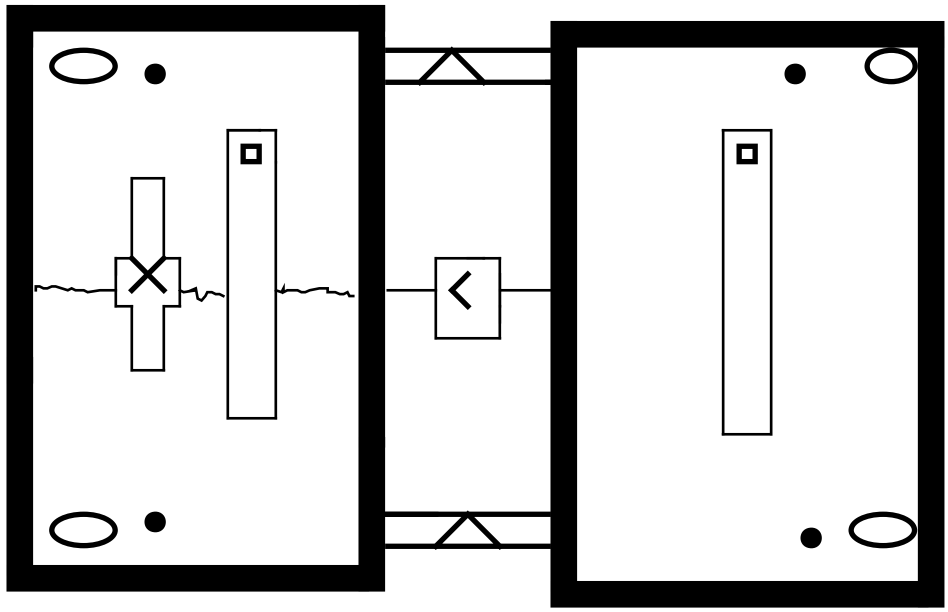
The author see salmon as agents to be employed productively for their own struggle to survive. As such, some minimal training is in order. Training to find food using current and light is a building block that leads directly to solving other deadly hazards that face salmon at the dams. The system approach has been taken to demonstrate that solutions to these problems are not unrelated and disconnected, but rather a continuum of one central theme: Use salmon to solve the problem - to locate feed, to serve as pathfinders, as bait, and to find their way back as adults with the experience to pass through dams.

New thinking is required to solve the problem of dams. New thinking is necessarily speculative and untested. Therefore I ask you to evaluate the underlying logic of these concepts with a single standard in mind:

Does this plan have potential?

I believe this year 2000 project should be funded. For your information, I have spent two years researching this project.

Hatchery Training System



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1. Existing Hatchery

Existing Concrete Center Barrier

Beginning Training Tube Extendable

Automatic Feeders - Computer Controlled

Blinking Light- Computer Controlled

Net Dividing Pen - During Training Sessions

Tubes Connecting Pens With Computer Controlled Gates

Computer Control Pump - for raising water level in exit pen and lowering in target pen.

<u>OPERATION OF TRAINING SYSTEM</u>

Beginning Training:
(One Week)

1. Turn on light, turn on feeder (1st 2 days)
2. Next, divide pen in half with net -all smolts to one side. Use short tube. Turn on light & feeder, open tube gate. Feed for 5 min., turn off, shut gate.
3. Lengthen training tube. Repeat training process.
4. Computer controlled- multiple small feedings, irregularly timed. Turn off system & shut gate after 5 minutes. Let unsuccessfull smolts go unfed.

Continued on next page.

OPERATION OF TRAINING SYSTEM -CONTINUED

Advanced Training: (Two Weeks)

1. Remove net. Smolts will swim between pens at feeding.
2. Pump System raises water level of exit pen (one with smolts) and lowers water level of target pen.
3. Turn on one feeder and related blinking light.
   Open related gate and repeat feeding routine.
   Non feeder gate remains closed. Alternate gates.

SYSTEM CALCULATIONS - TABLE A

For Eight Dams On Lower Columbia & Snake River

Cumulative Loss Projections

CURRENT SNAKE RIVER HATCHERY PROFILE		**CURRENT**	
Snake River Hatchery Release		100%	1,000,000
Cumulative Juvenile Downriver Losses:			
% Killed by Dams	(8 Dams)	40%	400,000
% Total Predation in Ecosystem		40%	400,000
Juveniles Reaching Ocean		20%	200,000
Juvenile Ocean Survival Rate:	% Reaching Adulthood	3%	6,000
Adult Harvest & Ladder Losses:			
% Ocean & River Catch of Adults		20%	1,200
% Fish Ladder Losses (16%) Loss Rate Per Dam			
Cumulative Adult Losses	(8 Dams)	75%	3,610
Adults Returning To Spawn (% of Smolts Released)		.0012	1,190

SYSTEMS ASSUMPTIONS:		**Cumulative Loss Rates - Dam**		
		Current Experience	50% **Effective**	75% **Effective**
Juveniles Captured By Collection Systems		0	50%	75%
Adjusted Juvenile Loss Rate:				
Current Loss Rate - All Factors				
Current Cumulative Losses - 8 Dams		80%		
50% Reduction in Cumulative Losses			40%	
75% Reduction in Cumulative Losses				20%
Ocean Survival Rate:		3.0%	3.0%	3.0%
Commercial, Indian, and Sport Harvest Rate		20%	20%	20%
Adult Fish Ladder Losses - Cumulative				
Current Losses	(16% Per Dam)	75.2%		
50% Improvement	(8% Per Dam)		48.7%	
75% Improvement	(4% Per Dam)			27.9%

Projection Of Returning Adults			
Juveniles Reaching The Ocean	200,000	600,000	800,000
Ocean Survival - 3%	6,000	18,000	24,000
Commercial Sport & Indian Harvest - 20%	1,200	3,600	4,800
Adult Fish Ladder Losses Cumulative	3,610	7,010	5,357
Adults Returning Above 8th Dam	1.190	7,390	13,843
	======	======	======

g. Facilities and equipment

Hatchery: Two pens for raising smolts are required for training purposes. The pens will be modified by connecting them with two training tubes.

Equipment needed include automated feeder, attractor lights, a beginning training tube, a pump, and a computer system for controlling the process. All Equipment requirements are standard off the shelf items except for the feeder which have to be built.

Total costs for hatchery equipment and modification is budgeted at $20,000.

Dam: For the year 2000 testing, access to waters behind a secondary dam, such as one on the Clackamas River is required to test the collection process. Trained smolts will be released upriver, tracked as they approach the dam, collected, and funnelled over to the exterior fish ladder for release. This is to test the tracking and collection processes only, in the year 2,000.

Equipment: Prototypes of the tracking system and the collector system will be designed and built.

Budgeted year 2000 costs for the tracking system is $10,000, and collection system prototype is $35,000.

h. Budget

		FYE 2000
Project management	(500 hrs @ $30)	$ 15,000
Payroll Taxes	(10%)	1,500
Supplies	(Feed, Supplies, Modeling)	8,000
Capital Acquisitions:	Hatchery Training System	20,000
	Computer Tracking System	10,000
	Collector Prototype	35,000
NEPA Costs		1,500
PIT Tags		1,000
Travel	(Meetings & Work Sites)	3,000
Indirect Costs	(Office , Phone, Secretarial)	6,000
Subcontractor	(Grad. Students/Skilled Retirees)	
	(1400 Hours @ $25)	35,000
Reserve		9,000
	FYE 2000 Total	$145,000
		=======

Schedule: Design and engineering work will begin September 1999.
Equipment acquistion & fabrication will start Jan. 2000.
Set up and testing of hatchery system in March 2000.
Train Smolts in April 2000.
Set up and testing of collection system in April 2000.
Wrap up project in June 2000.

Milestones: 95% of trained smolts successfully locate feed by third week and final week of training period.

30% of trained smolts captured by single collection system dam. (Only one collector will be built).

Future: Assuming FYE 2000 milestones achieved, FYE 2000/2002 would refine basic system. Design and testing of balance system would take place over two period.

Section 9. Key personnel

Senior Project Manager: Edward Krick CPA
Budget: $30 Hr, 500 Hours, $15,000
MBA, Indiana University
22 Years experience in business management as controller, executive management, and division manager in medium size companies. Self employed as ownerof CPA firm for the last eight years.

Engineering & Computer Systems Design:
Graduate Students from Portland State, University of Portland, and Oregon State plus skilled retirees.
Budget: $25 Hr, 1200 hours/ Yr 2000

Biological Consultation: Graduate Students from Oregon State
Budget: $25Hr, 200 hours/Yr 2000

Section 10. Information/technology transfer

(Replace this text with your response in paragraph form)

Congratulations!